

CLAIMS:

1. An electroconductive textile comprising:
  - a non-conductive textile,
  - 5 - a macromolecular template which is bonded to or entrapped in the non-conductive textile, and
  - a conductive polymer which is ordered by and bonded to the macromolecular template;such that the macromolecular template binds the conductive  
10 polymer to the non-conductive textile.
2. The electroconductive textile of claim 1, wherein the conductive polymer is an oxidatively polymerised  
15 conductive polymer.
3. The electroconductive textile of claim 1 or claim 2, wherein the conductive polymer is selected from polypyrrole and its derivatives, polythiophene and its derivatives, phenyl mercaptan and its derivatives, and  
20 polyaniline and its derivatives, polyindole and its derivatives, polycarbazole and its derivatives, or copolymers or combinations thereof.
4. The electroconductive textile of any one of claims 1  
25 to 3, wherein the conductive polymer is associated with one or more dopants or doping agents.
5. The electroconductive textile of any one of claims 1  
30 to 4, wherein the dopant or doping agent is derived from a strong acid, the macromolecular template or an oxidizing agent.
6. The electroconductive textile of any one of claims 1  
35 to 5, wherein the macromolecular template is a conductive macromolecular template.

7. The electroconductive textile claim 6, wherein the conductive macromolecular template is a conductive polymeric molecular template.
- 5 8. The electroconductive textile of claim 7, wherein the conductive polymeric molecular template contains one or more acid, ester or salt (electrolyte) groups, or derivatives thereof.
- 10 9. The electroconductive textile of claim 7, wherein the conductive polymeric molecular template contains sulfate, sulfonate, carboxylate, phosphonate, nitrate, or amide groups or acid equivalents thereof.
- 15 10. The electroconductive textile of claim 7, wherein the conductive polymeric molecular template is sulfonated or sulfated.
- 20 11. The electroconductive textile of any one of claims 7 to 10, wherein the conductive macromolecular template is selected from sulfonated polyanilines, sulfonated polypyrroles, and sulfonated polythiophenes, and derivatives thereof.
- 25 12. The electroconductive textile of claim 11, wherein the conductive polymer molecular template contains one or more functional groups selected from the group consisting of alkyl, alkenyl, alkynyl, aryl, halo, haloalkyl, haloalkenyl, haloalkynyl, haloaryl, hydroxy, alkoxy, alkenyloxy, aryloxy, benzyloxy, haloalkoxy, 30 haloalkenyloxy, haloaryloxy, nitro, nitroalkyl, nitroalkenyl, nitroalkynyl, nitroaryl, nitroheterocyclyl, amino, alkylamino, dialkylamino, alkenylamino, alkynylamino, arylamino, diarylamino, benzylamino, dibenzylamino, acyl, alkenylacyl, alkynylacyl, arylacyl, 35 acylamino, diacylamino, acyloxy, alkylsulfphonyloxy,

arylsulfphenyloxy, heterocyclyl, heterocycloxy,  
heterocyclamino, haloheterocyclyl, alkylsulfphenyl,  
arylsulfphenyl, carboalkoxy, carboaryloxy, mercapto,  
alkylthio, benzylthio and acylthio.

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13. The electroconductive textile of claim 7, wherein  
the macromolecular template is poly 2-methoxyaniline-5-  
sulfonic acid (PMAS).

10 14. The electroconductive textile of claim 7, wherein  
the macromolecular template is a cationic macromolecular  
template and the conductive polymer is an anionic  
conductive polymer.

15 15. The electroconductive textile of claim 7 wherein the  
macromolecular template is an anionic macromolecular  
template and the conductive polymer is a cationic  
conductive polymer.

20 16. The electroconductive textile of any one of claims 1  
to 15, wherein the macromolecular template is a  
polyelectrolytic molecular template.

25 17. The electroconductive textile of any one of claims 1  
to 16, wherein the macromolecular template provides an  
environment for facile oxidation of polymer subunits that  
form the conductive polymer.

30 18. The electroconductive textile of any one of claims 1  
to 5, wherein the macromolecular template is non-  
conductive.

35 19. The electroconductive textile of claim 18, wherein  
the macromolecular template is selected from the group of  
substances consisting of: polyvinylsulfonate, polystyrene

sulfonate, biologically active polymers, chondroitin sulfate and dextran sulfate, multicharged ions such as calixarenes, cyclodextrins, polymeric textile dyestuffs thermally sensitive polyelectrolytes, redox containing  
5 polyelectrolytes, UV absorbers, fluorescent whitening agents, natural and synthetic tanning agents, lignin and its derivatives, stain blocking agents and shrinkproofing polymers, with the proviso that the substance functions as molecular template by providing a template upon which, or  
10 in relation to which, polymer subunits of the conductive polymer preferentially align to induce orientation of the subunits for forming the conductive polymer, and bonds to or is entrapped within the non-conductive textile.

15 20. The electroconductive textile of any one of claims 1 to 5, wherein:

the macromolecular template is selected from the group consisting of sulfonated polyanilines or derivatives thereof, sulfonated polystyrenes or derivatives thereof,  
20 dextran sulfate, calixarenes, cyclodextrins and derivatives thereof, synthetic tanning agents based upon sulfonated polycondensation products derived from aromatic sulfonic acids or sulfones and formaldehyde, synthetic tanning agents based upon polyacrylic-acid or salts or  
25 esters thereof, polypropylene oxide polyurethane shrinkproofing polymers containing reactive carbamoyl sulfonate groups, sulfonated polypyrroles or derivatives thereof, sulfonated polythiophenes or derivatives thereof, and copolymers or mixtures of any of the above; and

30 the conductive polymer is selected from the group consisting of polyaniline, polypyrrole, polythiophene, polyphenyl mercaptan polyindole, polycarbazole or derivatives or a copolymer or combination thereof.

35 21. The electroconductive textile of any one of claims 1 to 20, wherein the non-conductive textile contains no functionalisation which would enable a reaction forming a

covalent bond between the textile and the macromolecular template, and contains no phosphonylation.

22. The electroconductive textile of any one of claims 1  
5 to 21, wherein the non-conductive textile is formed from natural or synthetic fibers, or a combination thereof.

23. The electroconductive textile of claim 22, wherein  
10 the non-conductive textile contains natural fibres.

24. The electroconductive textile of any one of claims 1  
to 23, wherein the electroconductive textile contains no  
curing binder.

15 25. The electroconductive textile of any one of claims 1 to 24, comprising one or more further layers of conductive polymer.

26. A method for preparing an electroconductive textile  
20 from a non-conductive textile and polymer subunits which, when polymerised, form a conductive polymer, the method comprising the steps of:

(i) polymerising the polymer subunits in the presence  
of a macromolecular template to form the conductive  
25 polymer bound to the macromolecular template; and

(ii) contacting the macromolecular template with the  
non-conductive textile to effect bonding of the  
macromolecular template to the non-conductive textile.

30 27. The method of claim 26, wherein the macromolecular template is contacted with the non-conductive textile by padding, exhaustion, printing or coating techniques.

28. The method of claim 26 or claim 27, wherein the  
35 macromolecular template is applied in an amount of between 0.1 and 50% on mass of fabric.

29. The method of claim 28, wherein the macromolecular template is contacted with the non-conductive textile in an amount of 3-20% on mass of fabric.

5 30. The method of claim 28, wherein the macromolecular template is applied to the non-conductive textile in an amount of between 5 and 10% on mass of fabric.

31. The method of any one of claims 26 to 30, wherein,  
10 prior to step (ii), the non-conductive textile is contacted with surfactant.

32. The method of any one of claims 26 to 31, wherein step (ii) comprises contacting a solution of the  
15 macromolecular template with the non-conductive textile at an initial solution pH of between 1.0-9.0.

33. The method of claim 32, wherein the initial solution pH is between 1.0-2.7.  
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34. The method of claim 32, wherein the initial solution pH is between 1.4 - 1.8.

35. The method of any one of claims 26 to 34, wherein  
25 step (ii) comprises contacting a solution of the macromolecular template with the non-conductive textile at a temperature of between 20 and 130°C.

36. The method of claim 35, wherein step (ii) is  
30 conducted by the exhaust technique.

37. The method of claim 36, wherein the contact temperature is between 60 and 100°C, and the time of contact is a period of at least 30 minutes.

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38. The method of claim 36, wherein the contact temperature is between 80 and 100°C.

39. The method of claim 37 or claim 38, wherein the time of contact is at least 3 hours.

5 40. The method of any one of claims 26 to 35, wherein step (ii) is conducted by the padding technique.

41. The method of claim 40, wherein step (ii) comprises contacting a padding liquid containing 20-200 grams/litre  
10 of the molecular template with the non-conductive textile.

42. The method of claim 41, wherein the pH of the padding liquid is between 1.0 - 1.8.

15 43. The method of claim 41 or 42, wherein step (ii) effects application of between 5 and 50% of the macromolecular template on mass of the fabric.

44. The method of any one of claims 26 to 43, wherein  
20 the method comprises the steps of:

(a) contacting the macromolecular template with the non-conductive textile to effect bonding of the macromolecular template to the non-conductive textile, and

(b) contacting the polymer subunits with the  
25 macromolecular template bound to the non-conductive textile, and polymerising the polymer subunits to form the conductive polymer bound to the macromolecular template and to the non-conductive textile via the macromolecular template.

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45. The method of claim 44, wherein the polymer subunits are polymerised by adding an oxidizing agent.

46. The method of claim 45, wherein the molar ratio of  
35 the polymer sub units to the oxidant is between 1:0.16 and 1:0.5.

47. The method of claims 44 to 46, wherein a solution of the polymer subunits is contacted with the molecular template bound to the non-conductive textile, and the pH during contacting stage (b) is between 1.1 - 4.0.

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48. The method of claim 47, wherein the pH of contacting step (b) is between 1.1 - 2.4.

49. The method of claim 47, wherein the pH of the contacting step (b) is between 1.1 - 1.8.

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50. The method of any one of claims 44 to 49, wherein the polymer subunits are polymerized at ambient temperature.

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51. The method of any one of claims 26 to 50, wherein the molar ratio of macromolecular template to the polymer subunits is between 1:1 and 1:40.

52. The method of 51, wherein the molar ratio is about 1:2.

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53. The method of any one of claims 26 to 43, wherein the method comprises the steps of:

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(a) contacting the non-conductive textile, the macromolecular template and the polymer subunits with one another to effect bonding of the macromolecular template to the non-conductive textile, and bonding of the macromolecular template to the polymer subunits, and

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(b) polymerising the polymer subunits to form the conductive polymer which is bound to the non-conductive textile via the macromolecular template.

54. The method of claim 53, wherein step (a) involves contacting a solution of the macromolecular template and the polymer subunits with the non-conductive textile, and step (b) comprises the addition of an oxidant to the

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solution containing the non-conductive textile.

55. The method of any one of claims 26 to 43, wherein the method comprises the steps of:

5 (a) contacting the macromolecular template with the polymer subunits and polymerising the polymer subunits to form the conductive polymer bound to the macromolecular template, and

10 (b) contacting the macromolecular template with the non-conductive textile to effect bonding of the macromolecular template to the non-conductive textile, with the conductive polymer bound to the non-conductive textile via the macromolecular template.

15 56. The method of claim 55, wherein step (a) comprises forming an aqueous solution of the macromolecular template and the polymer subunits, reducing the pH of the solution to a value between 1.1 - 2.4, and contacting the solution with an oxidant.

20 57. The method of claim 56, wherein the molar ratio of polymer subunits to oxidant is between 2:1 and 1:1.

58. The method of any one of claims 55 to 57, wherein  
25 the molar ratio of macromolecular template to polymer subunits is between 1:1 - 1:4.

59. The method of any one of claims 26 to 58, wherein:  
the macromolecular template is selected from the  
30 group consisting of sulfonated polyanilines or derivatives thereof, sulfonated polystyrenes or derivatives thereof, dextran sulfate, calixarenes, cyclodextrins and derivatives thereof, synthetic tanning agents based upon sulfonated polycondensation products derived from aromatic  
35 sulfonic acids or sulfones and formaldehyde, synthetic tanning agents based upon polyacrylic-acid or salts or esters thereof, polypropylene oxide polyurethane

shrinkproofing polymers containing reactive carbamoyl sulfonate groups, sulfonated polypyrroles or derivatives thereof, sulfonated polythiophenes or derivatives thereof, and copolymers or mixtures of any of the above; and

5       the conductive polymer is selected from the group consisting of polyaniline, polypyrrole, polythiophene, polyphenyl mercaptan polyindole, polycarbazole or derivatives or a copolymer or combination thereof.

10   60.   An article formed partly or entirely from the electroconductive textile of any one of claims 1 to 25.

61.   An article formed partly or entirely from the electroconductive textile produced by the method of any  
15   one of claims 26 to 59.

62.   The article of claim 60 or claim 61, wherein the article is selected from gloves, car seats, heating panels for car seats, protective clothing, hosiery, apparel  
20   items, footwear, headgear, strange gauges, energy storage devices and energy conversion devices.